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Educational Forum
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Sierra Vista, AZ

by

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Sierra Vista Subwatershed

This map illustrates the Sierra Vista Subwatershed, a region in southeastern Arizona. The San Pedro River is the central feature, flowing northward through the subwatershed. Key locations include Fairbank, Tombstone, Charleston, Fort Huachuca, Sierra Vista, Hereford, Nicksville, Palominas, and Bisbee. The map also shows the San Pedro Riparian National Conservation Area, the Coronado National Forest, and the Huachuca Mountains. The subwatershed is divided into 12 numbered segments. The map includes a scale bar (0 to 10 kilometers and 0 to 6 miles) and a north arrow. The base map is from the U.S. Geological Survey digital data, 1:100,000, 1982, using the Universal Transverse Mercator projection, Zone 12.

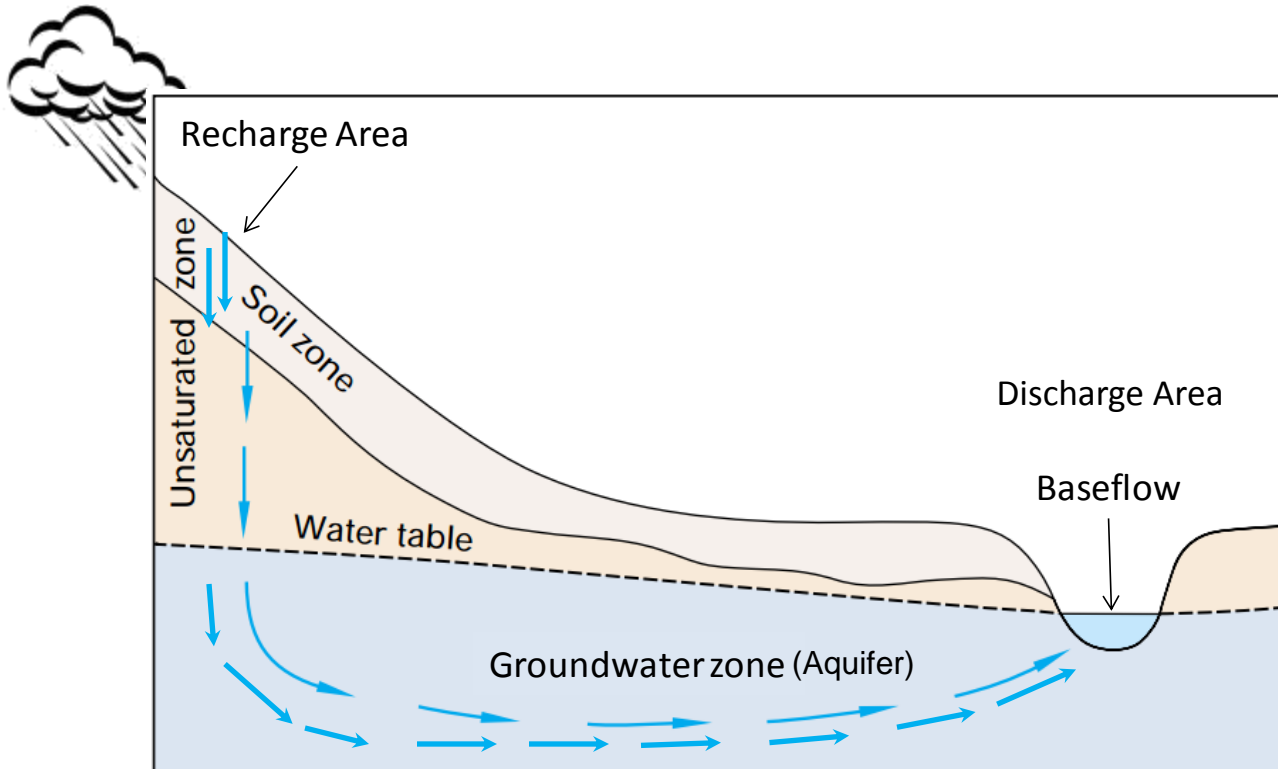
Base from U.S. Geological Survey digital data, 1:100,000, 1982
Universal Transverse Mercator projection, Zone 12

0 10 KILOMETERS
0 6 MILES

UNITED STATES
MEXICO

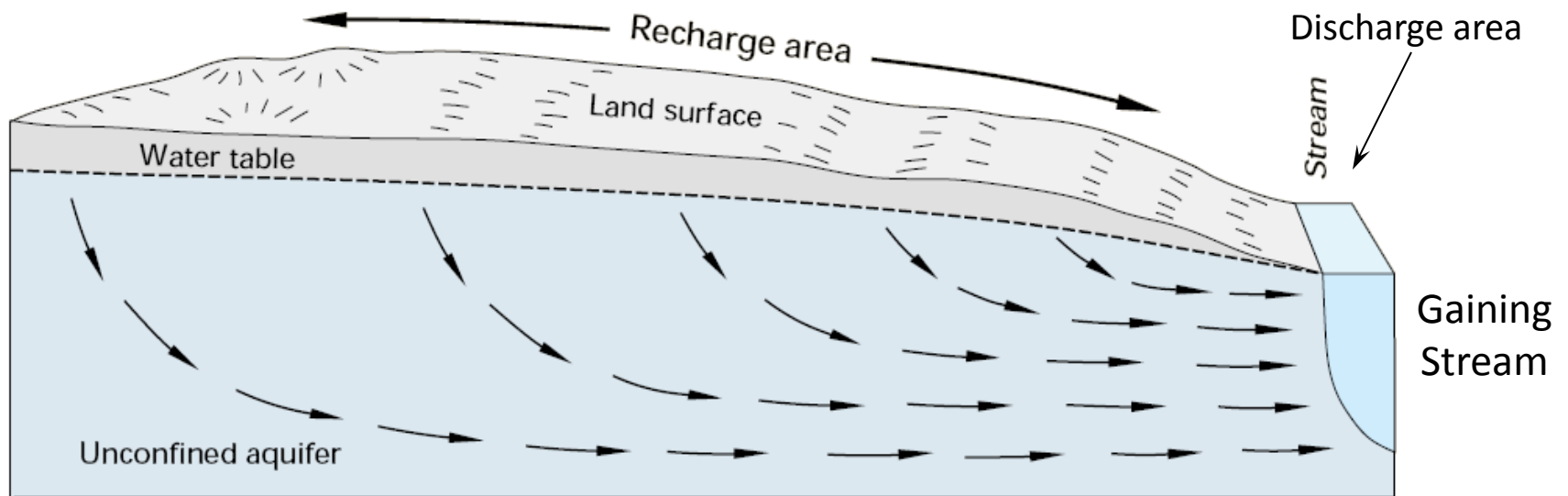
ARIZONA
SONORA

Groundwater and Surface Water: How Are They Related?



Source: Winter, T.C., J.W. Harvey, Franke, O.L., and W.M. Alley, 1998, *Ground Water and Surface Water – A Single Resource*, U.S. Geological Survey Circular 1139, Denver, CO.

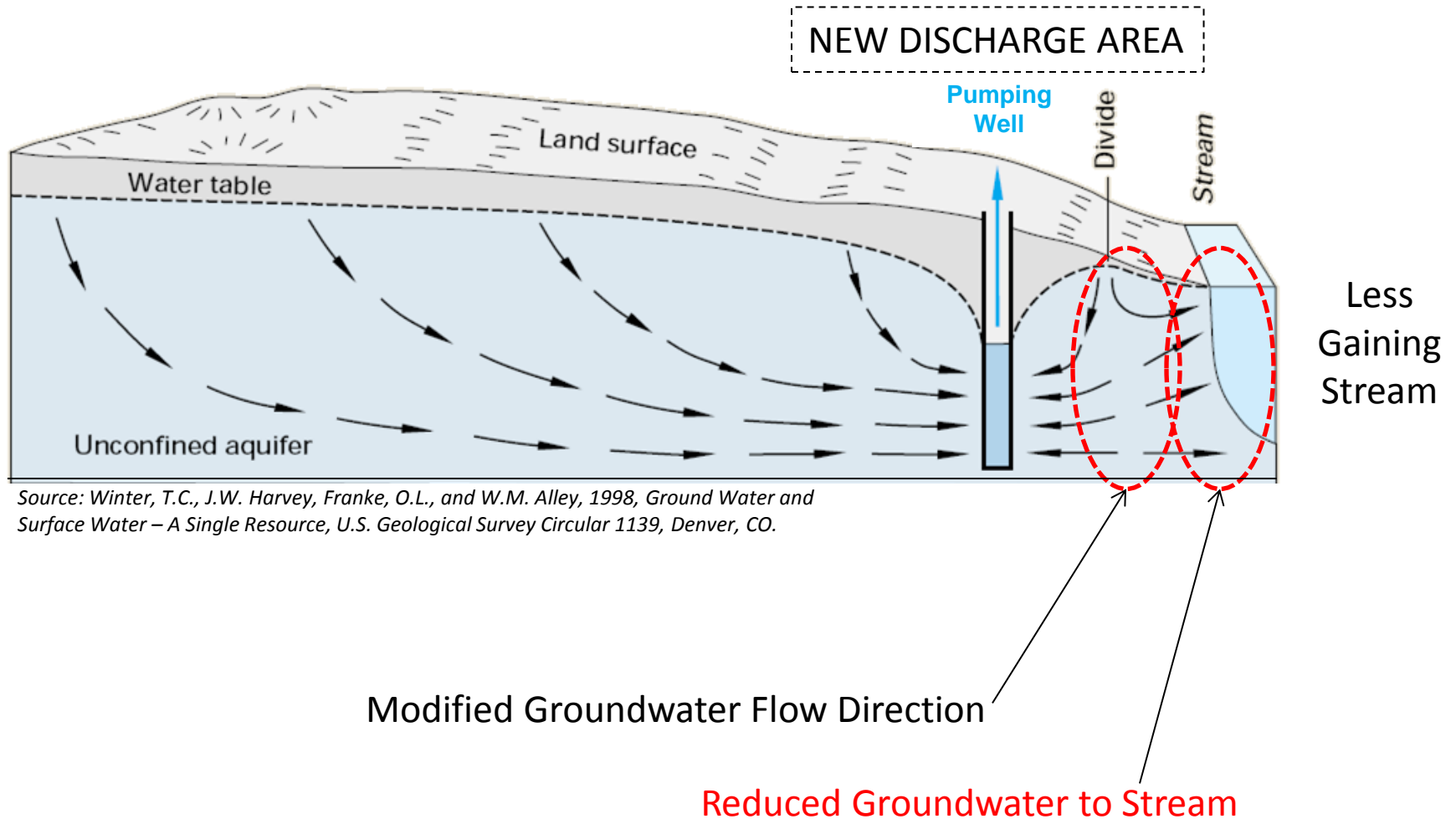
Natural System – Gaining Stream



Source: Winter, T.C., J.W. Harvey, Franke, O.L., and W.M. Alley, 1998, *Ground Water and Surface Water – A Single Resource*, U.S. Geological Survey Circular 1139, Denver, CO.

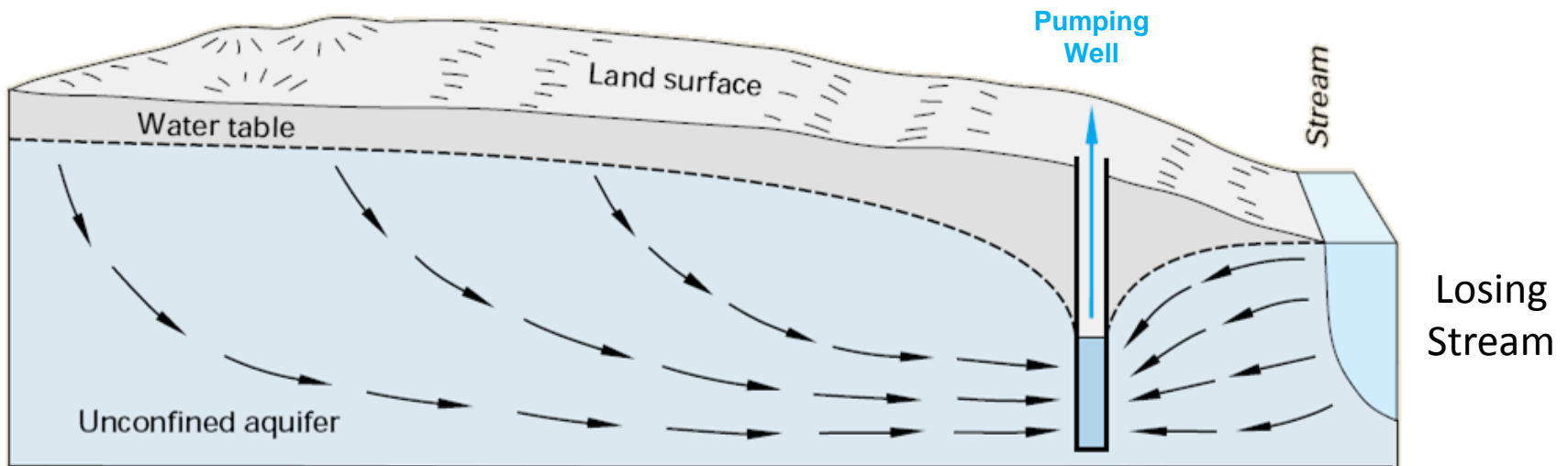
Effects of Pumping on Baseflow

Intermediate Time



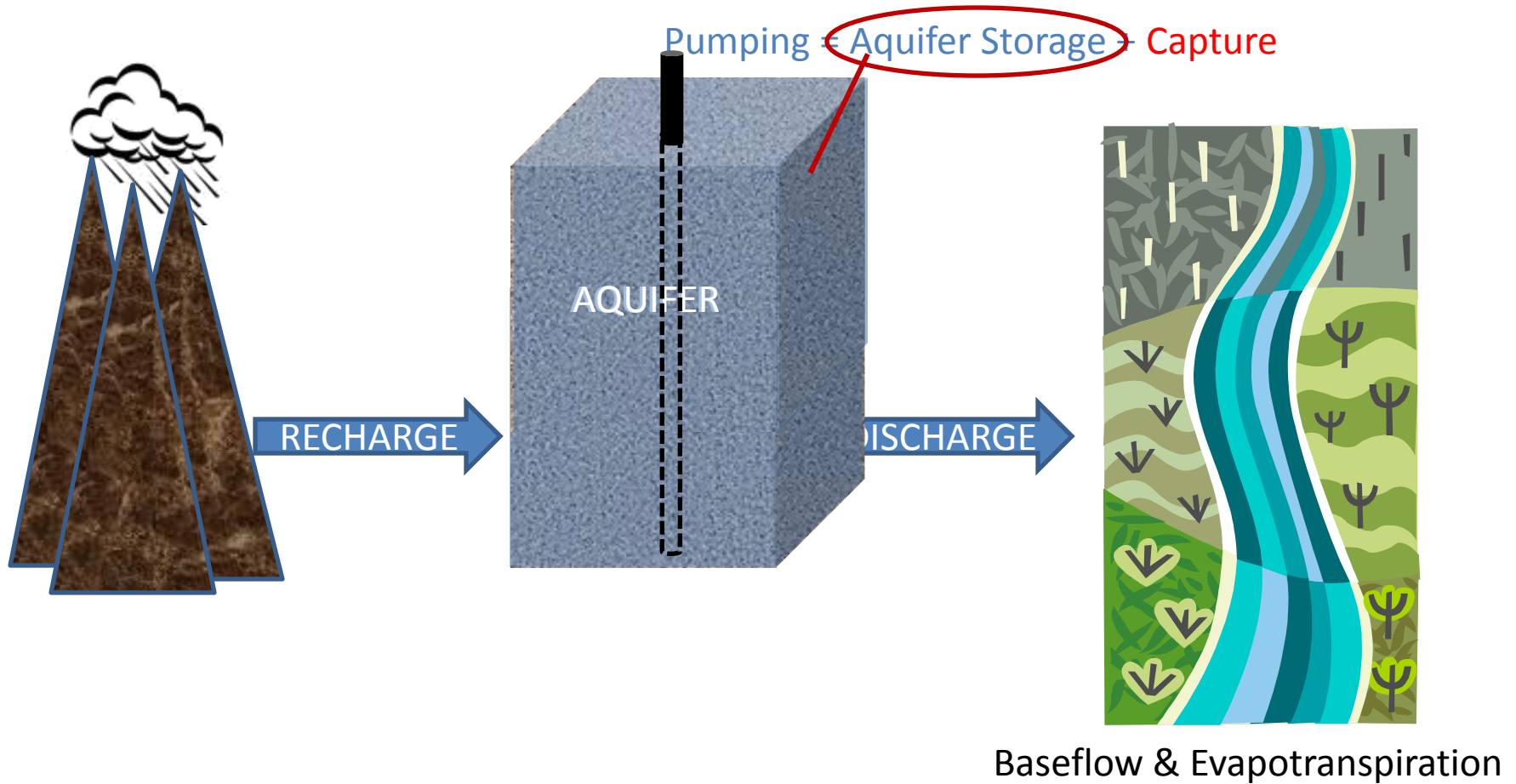
Source: Winter, T.C., J.W. Harvey, Franke, O.L., and W.M. Alley, 1998, *Ground Water and Surface Water – A Single Resource*, U.S. Geological Survey Circular 1139, Denver, CO.

After Prolonged Pumping



Source: Winter, T.C., J.W. Harvey, Franke, O.L., and W.M. Alley, 1998, *Ground Water and Surface Water – A Single Resource*, U.S. Geological Survey Circular 1139, Denver, CO.

Natural Conditions: RECHARGE = DISCHARGE



Capture:

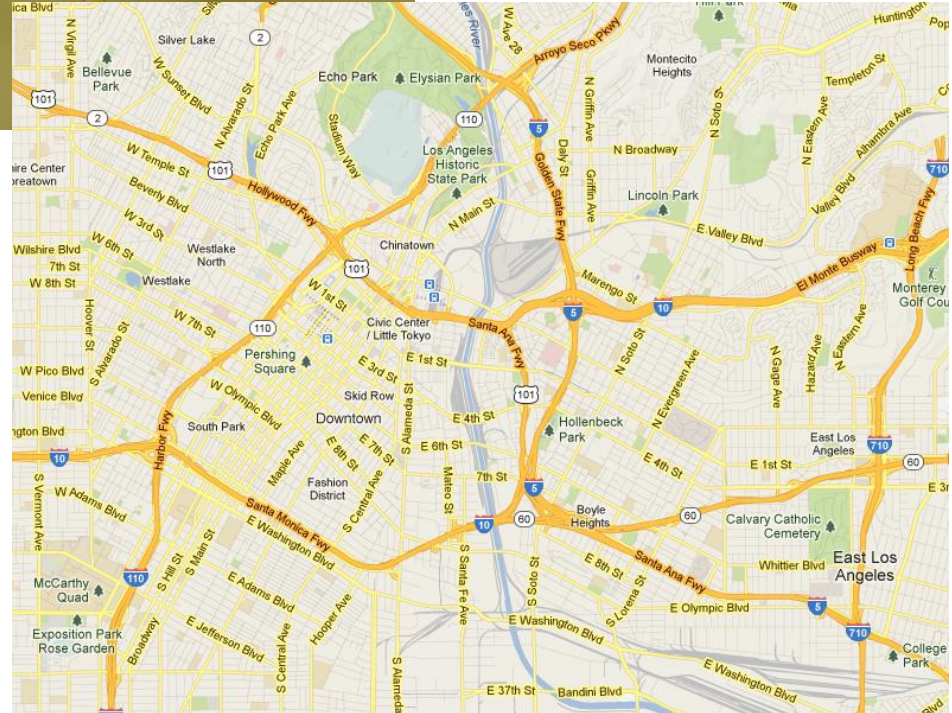
Increased RECHARGE + Decreased DISCHARGE

How Can We Predict Capture From Future Pumping?

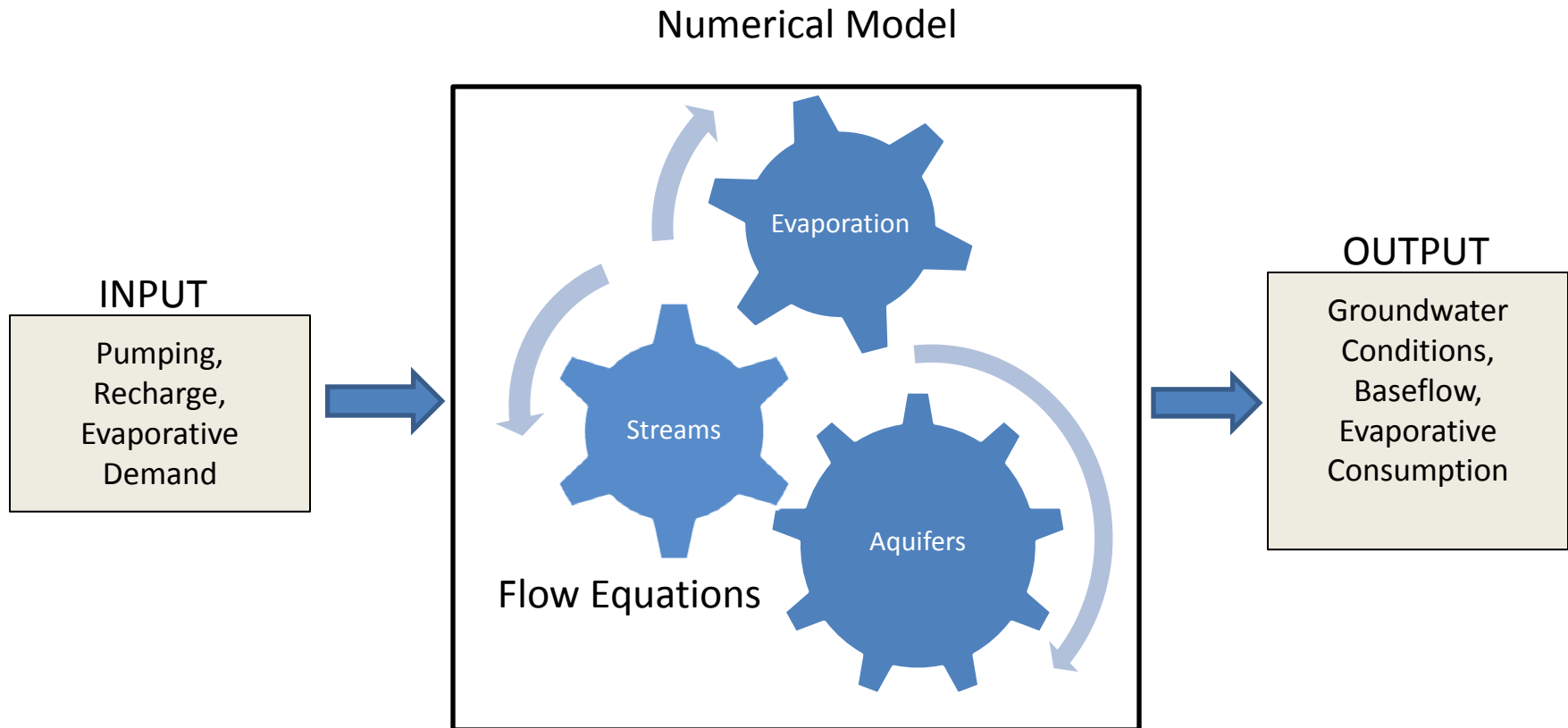
with a

Groundwater Model

-- Merriam-Webster Dictionary definition no. 11

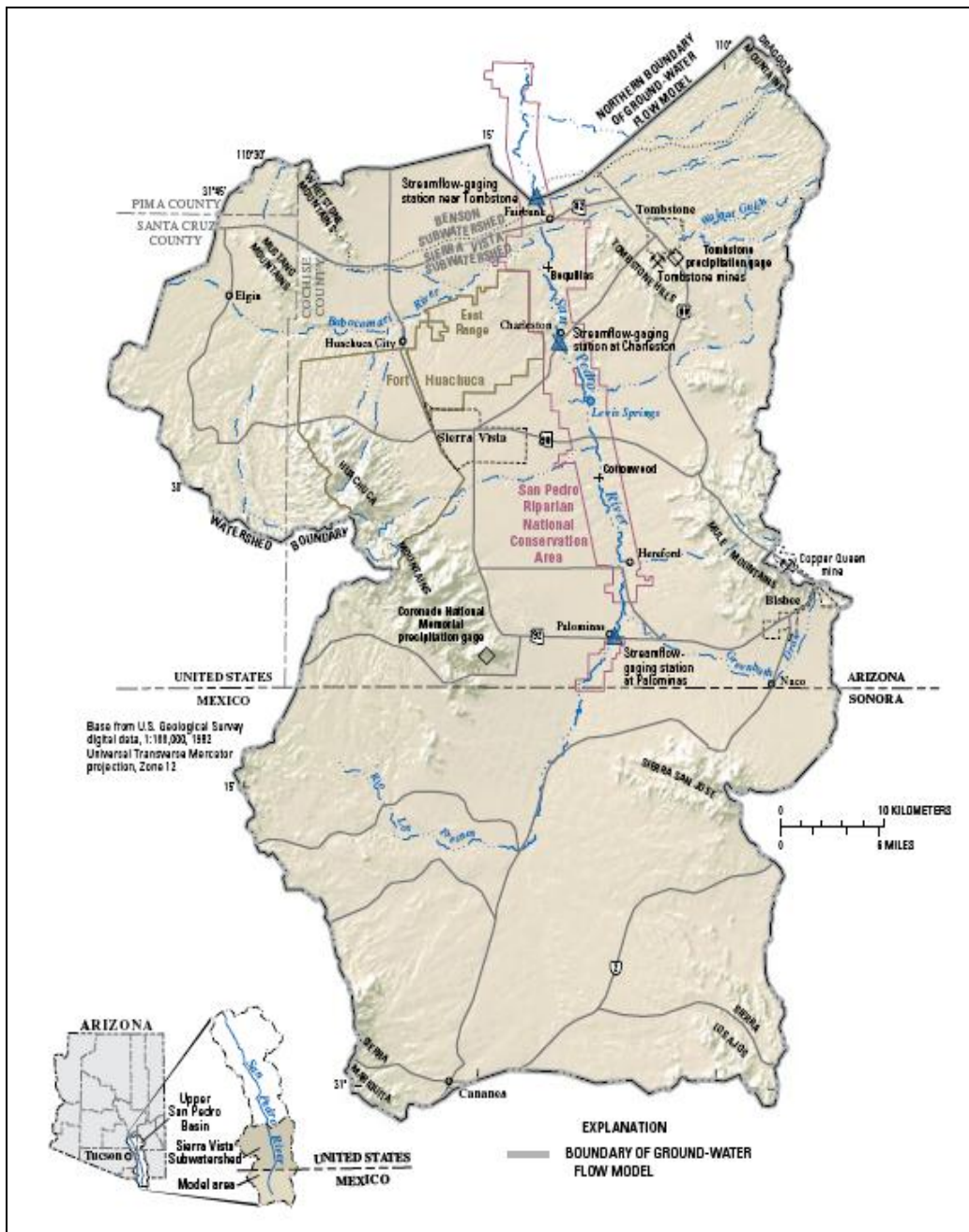


GROUNDWATER MODEL: A Computer Program that Uses Flow Equations to Make Sense of a Complex Natural System.



Upper San Pedro Basin Groundwater Model: (Pool and Dickinson, 2007, USGS)

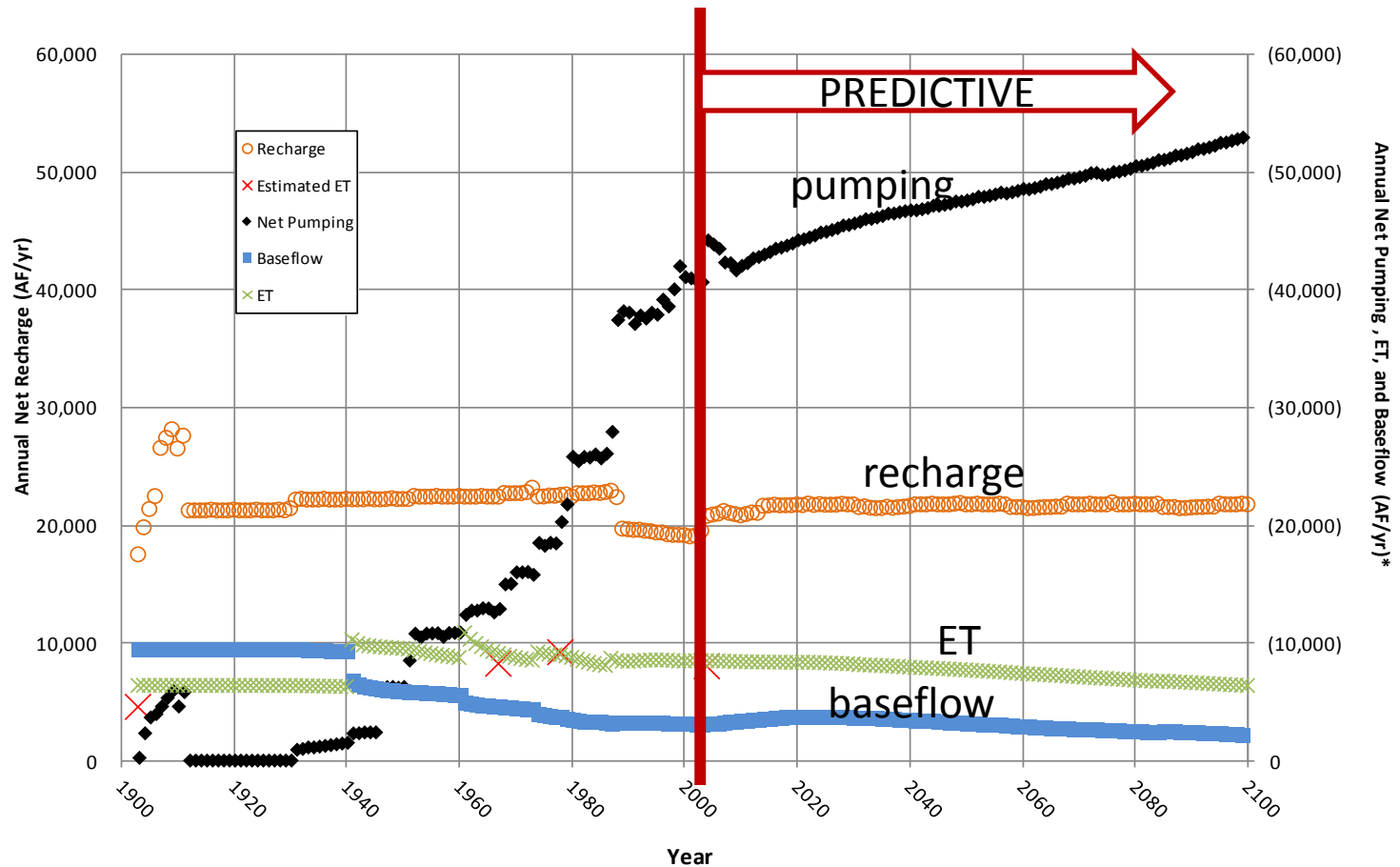
- 2 seasons
- Includes most of SPRNCA
- Calibrated from 1902-2003
- Includes entire upper basin
- Forward modeling from 2003-2100 by Lacher (2011)



What This Groundwater Model Does **NOT** Do:

- 
- Surface runoff
 - Flood flows
 - Streambank storage

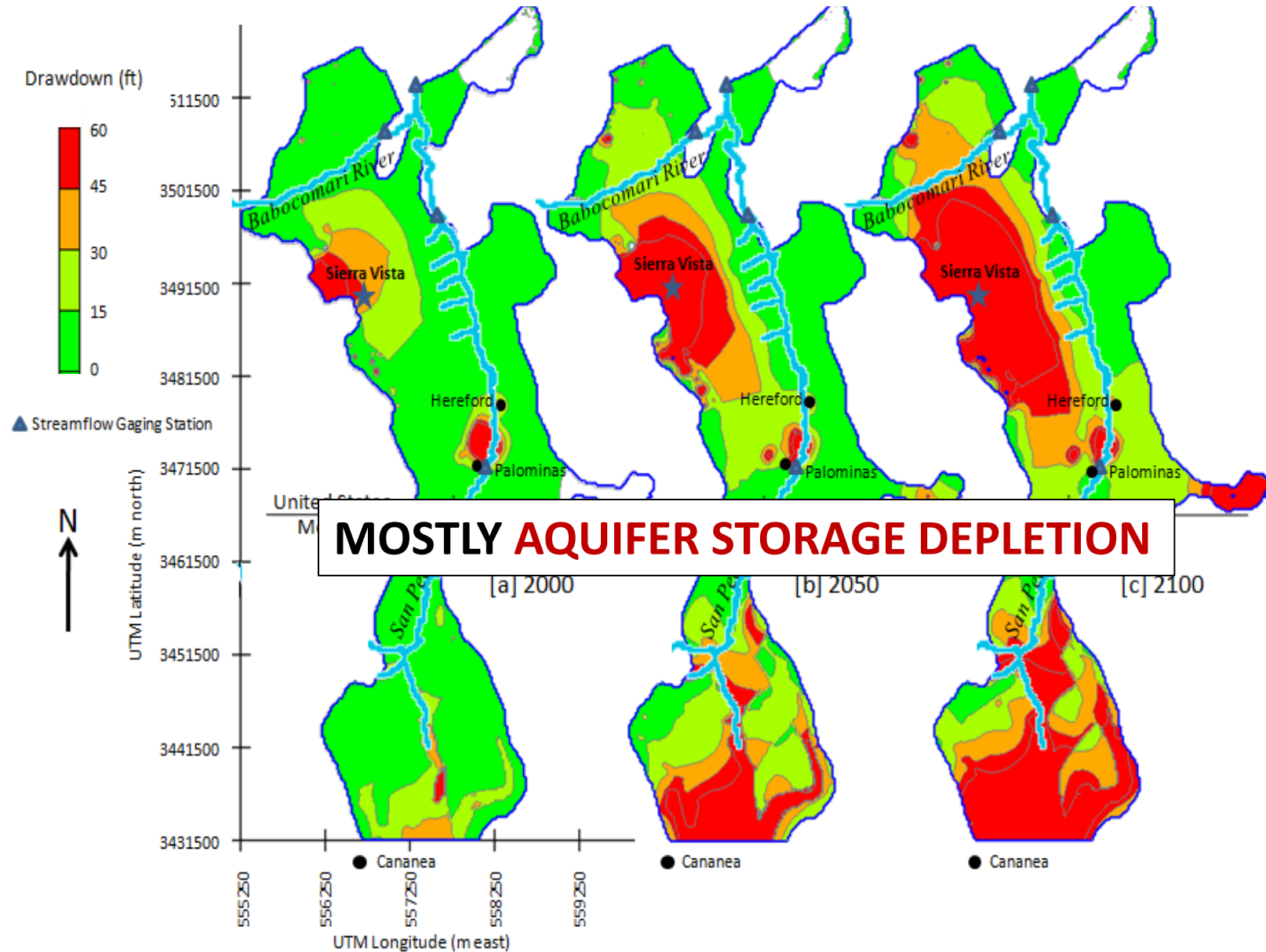
Simulated Annual Net Pumping, Baseflow, ET, and Recharge, 1902-2100

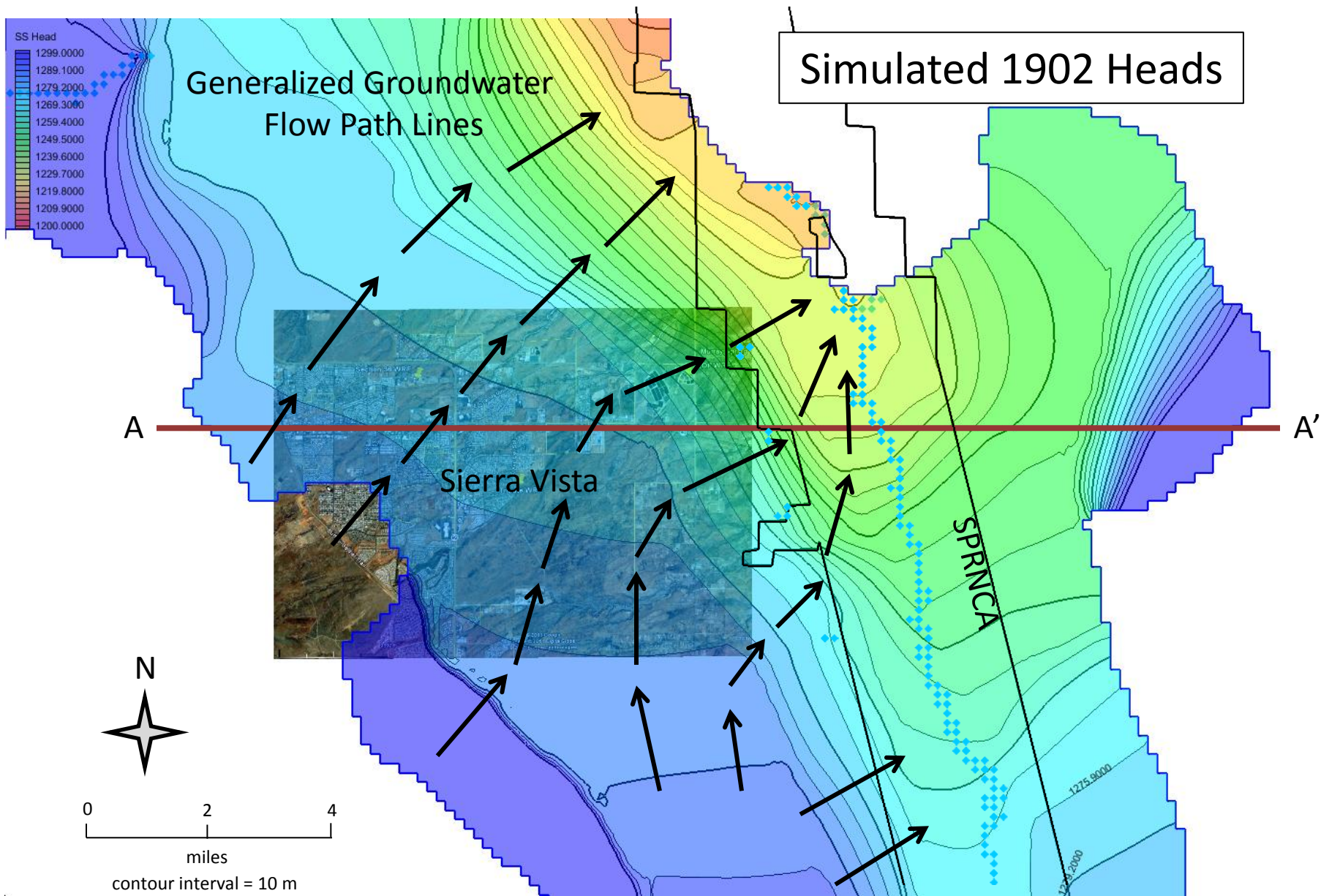


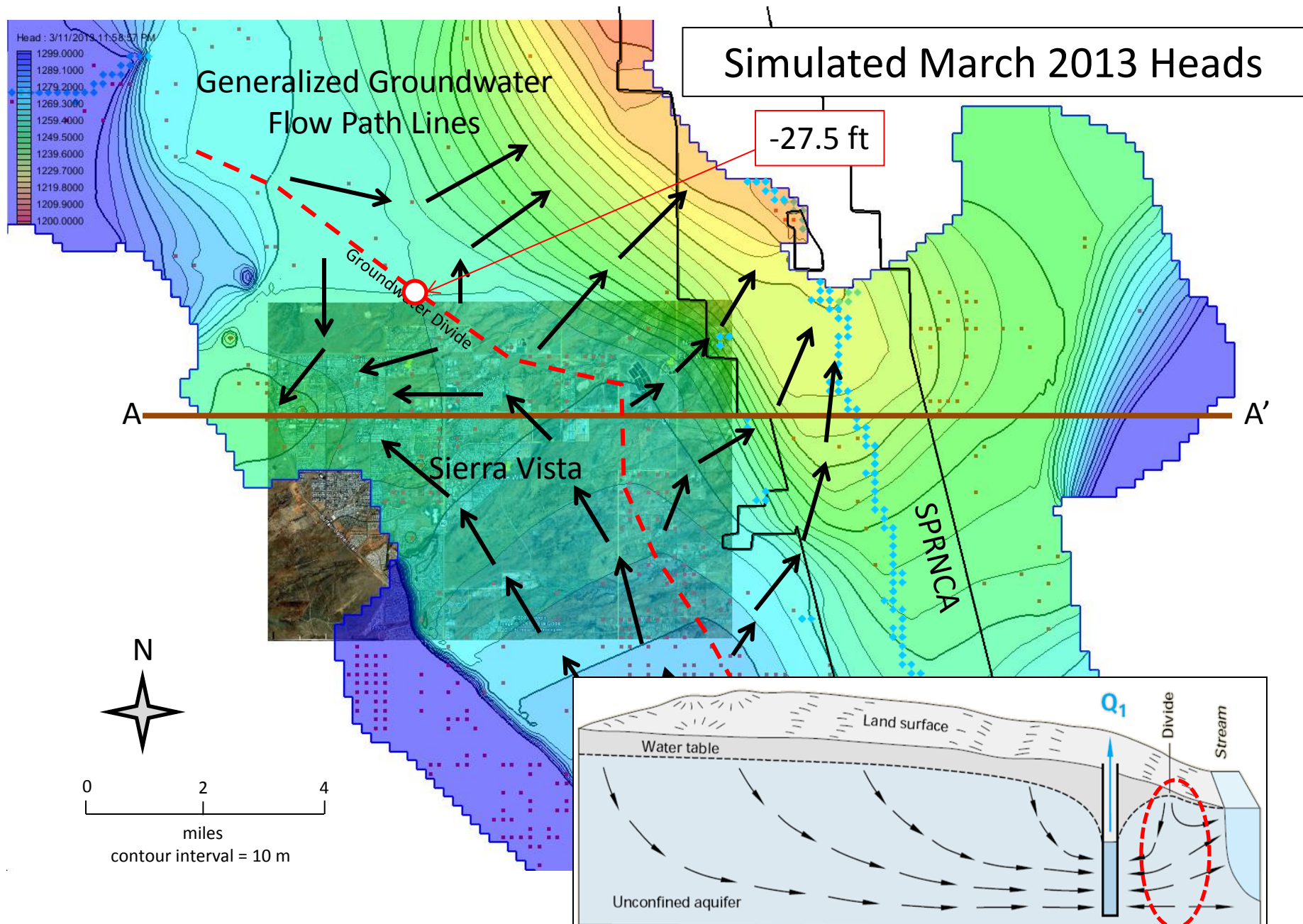
* Negative values reflect MODFLOW sign convention for water leaving aquifer.

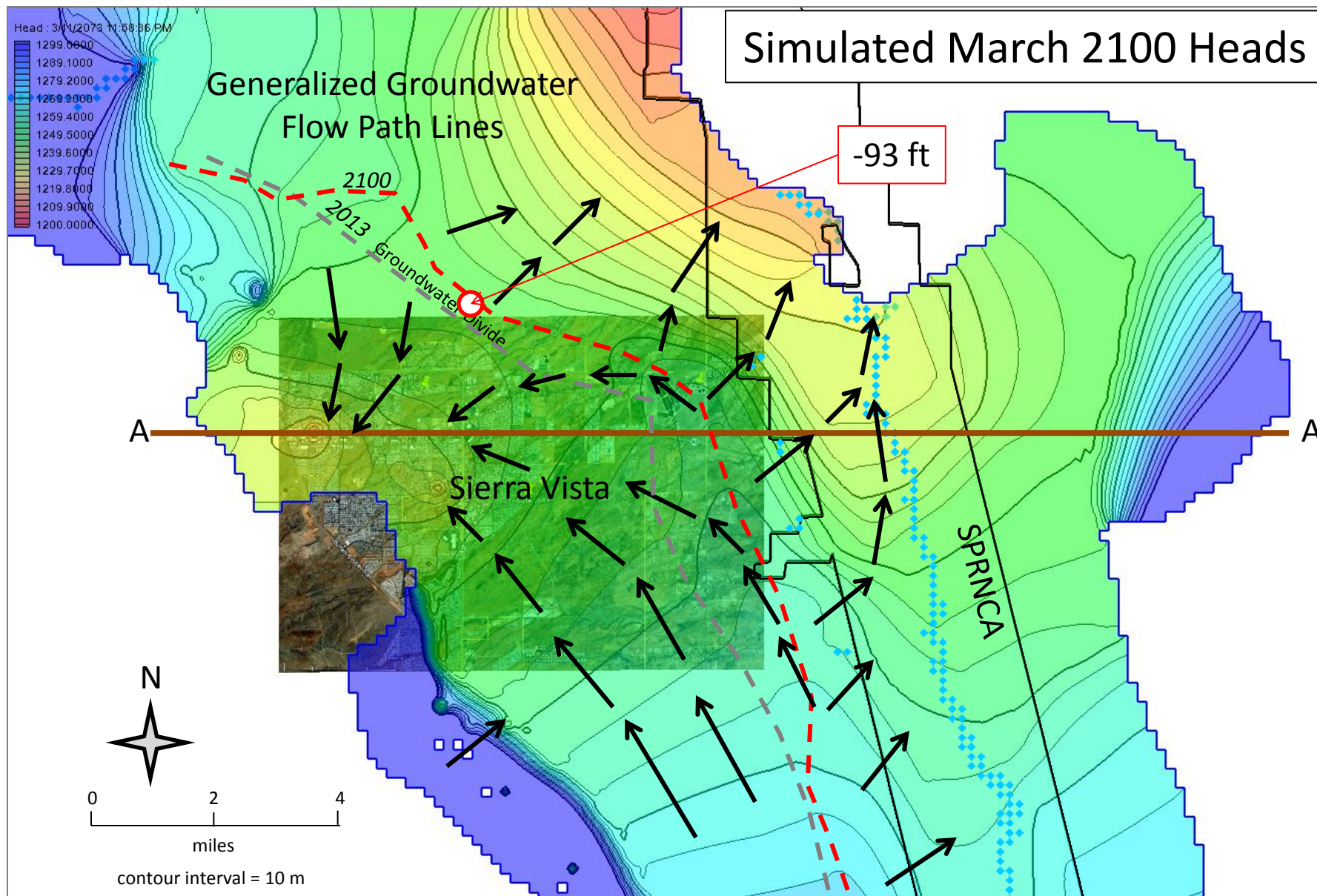
Simulated Drawdown in Regional Aquifer (Model Layer 4)

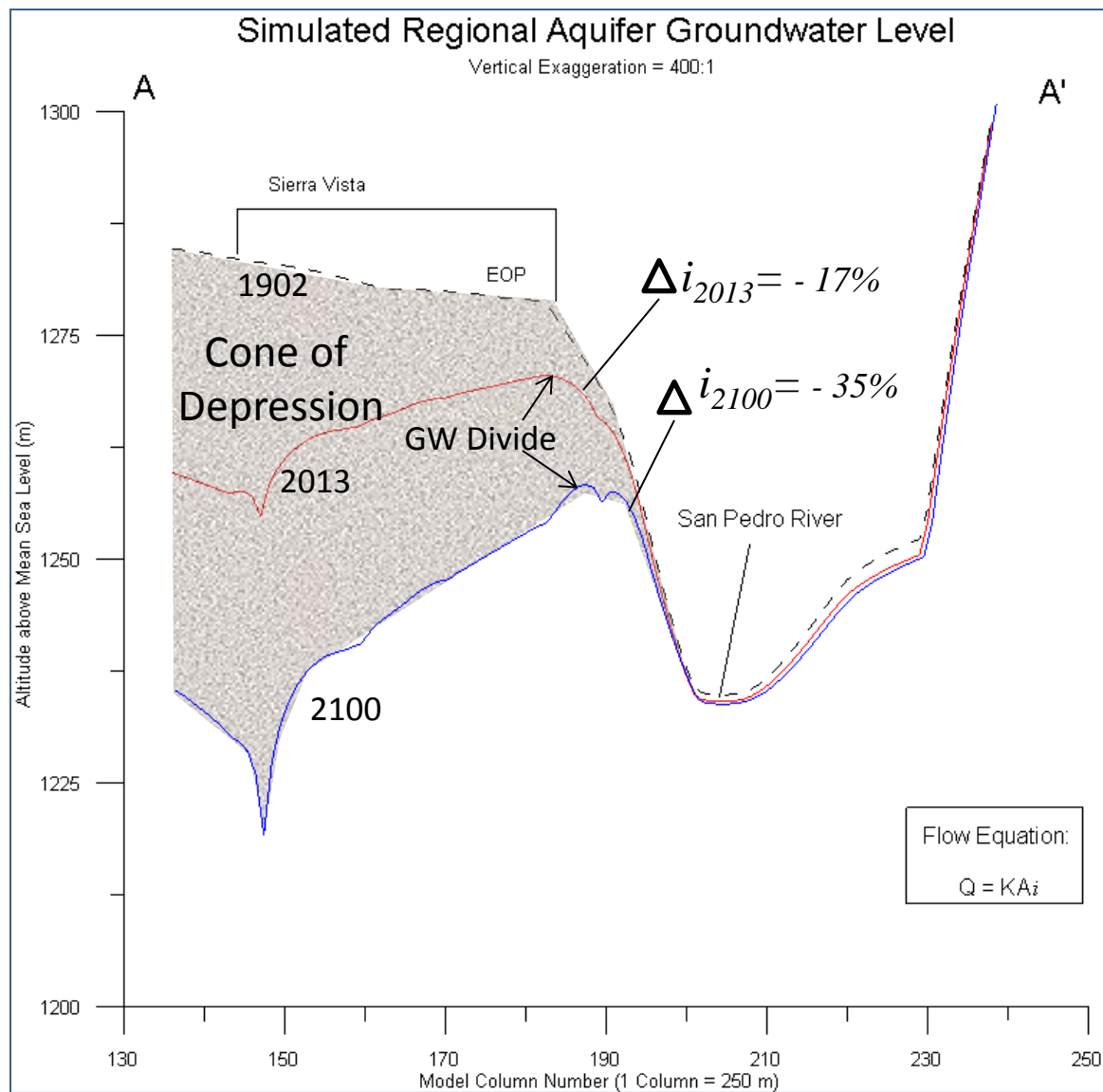
contour interval = 15 feet





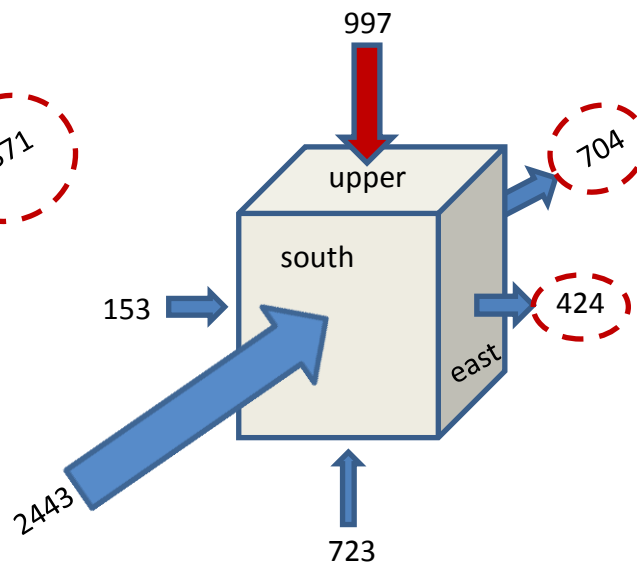
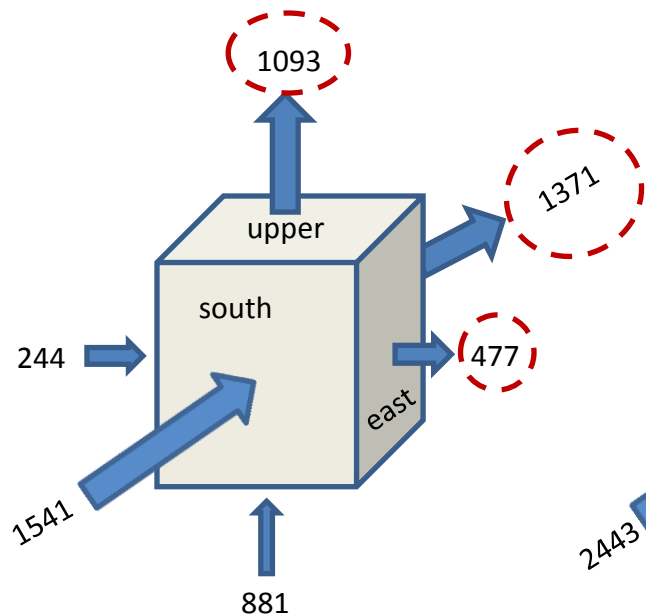




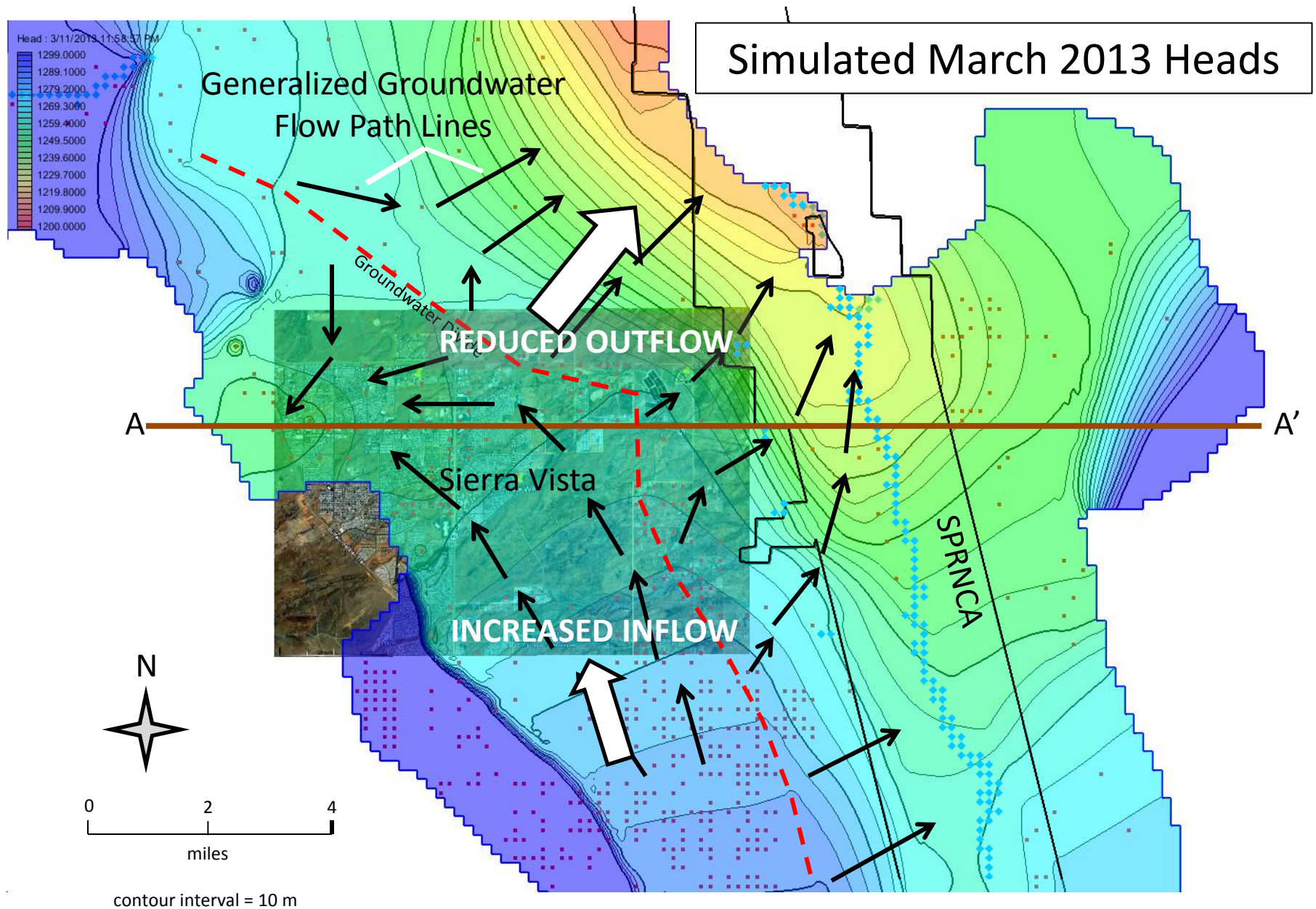


PRE-DEVELOPMENT

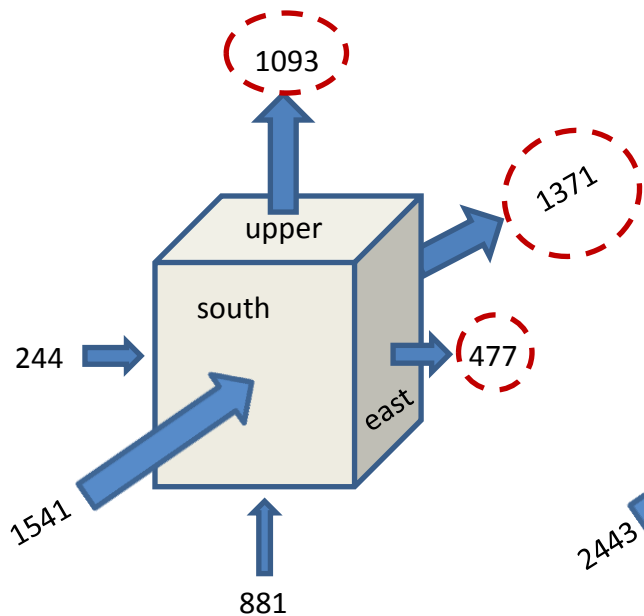
March 2013



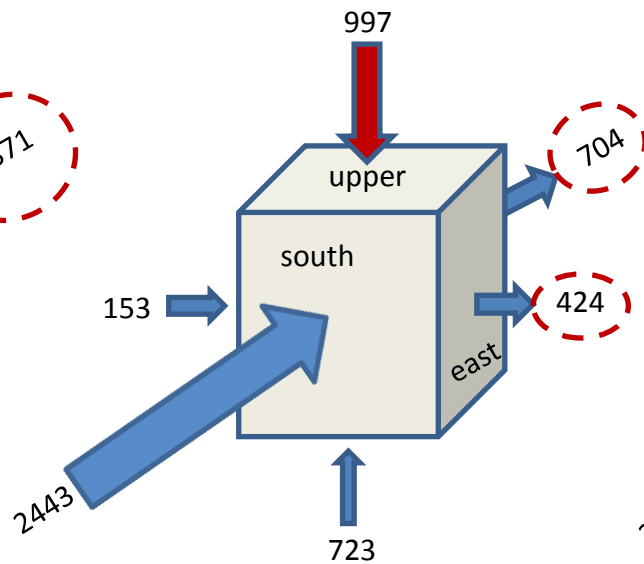
Total Capture
1902-2013:
3461 AF/yr



PRE-DEVELOPMENT

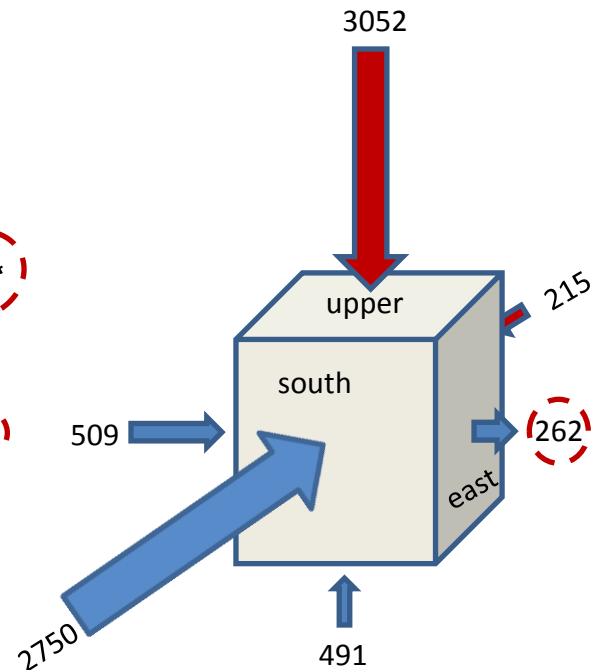


March 2013



Total Capture
1902-2013:
3461 AF/yr

March 2100

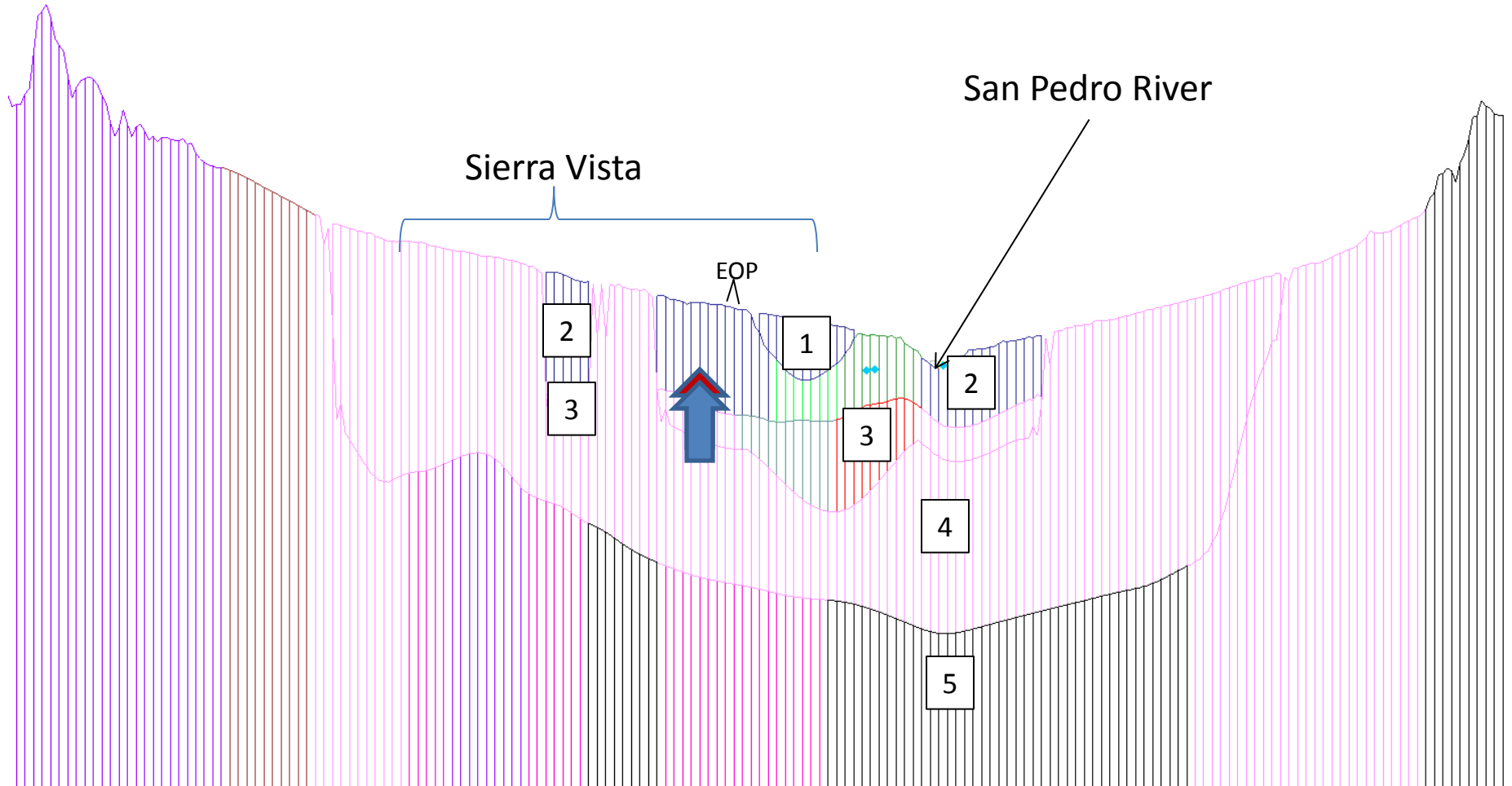


Total Capture
1902-2100:
7027 AF/yr

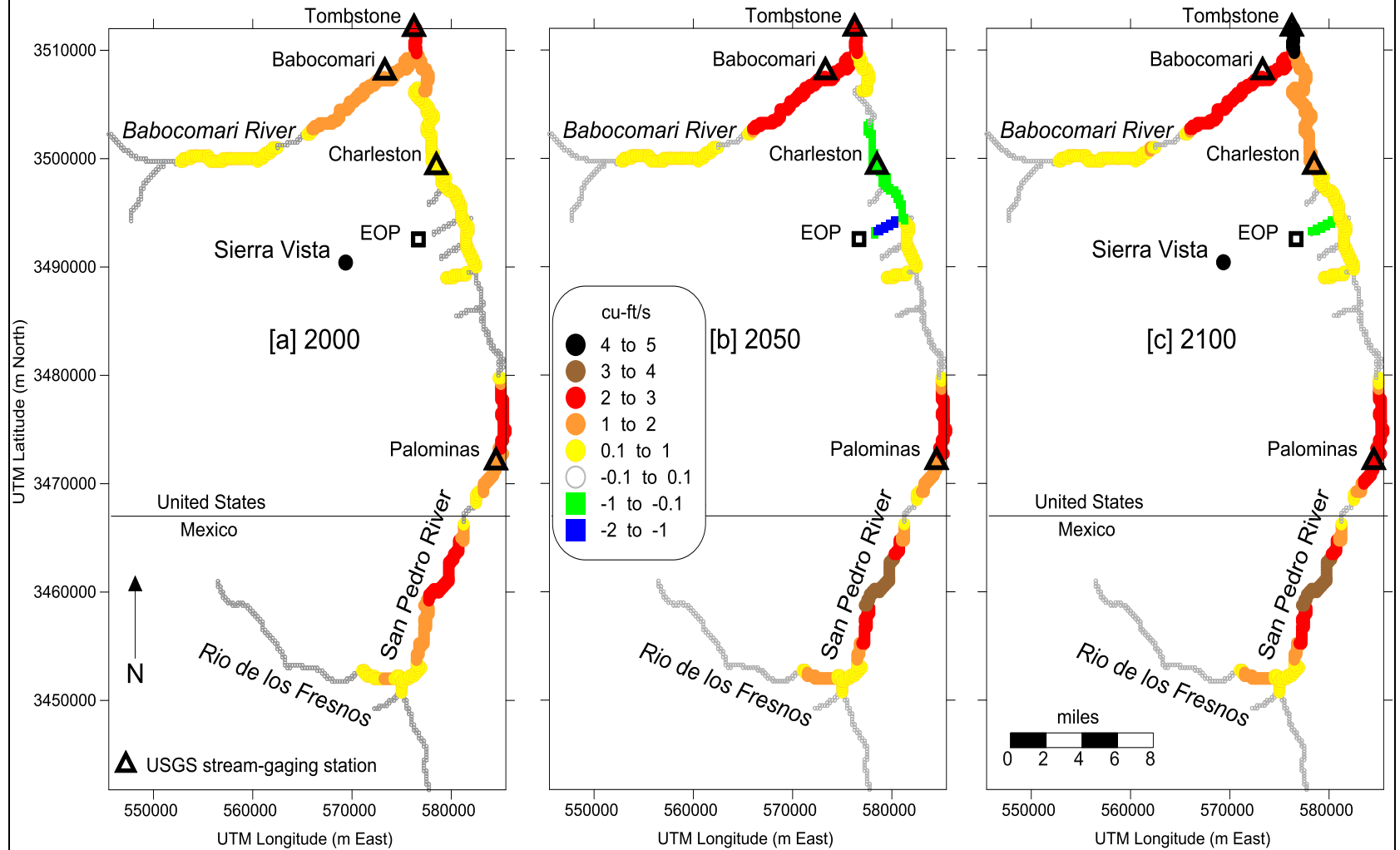
Fry Boulevard Cross-Section

West

East



Simulated Cool-Season (October - March) Baseflow Capture



Take-Home Message

- Most pumping in the Upper San Pedro Basin during 20th century came from aquifer storage.
- Over the next century, pumping will increasingly draw from aquifer storage in the area southeast of Sierra Vista and from baseflow and ET from the San Pedro and Babocomari rivers.

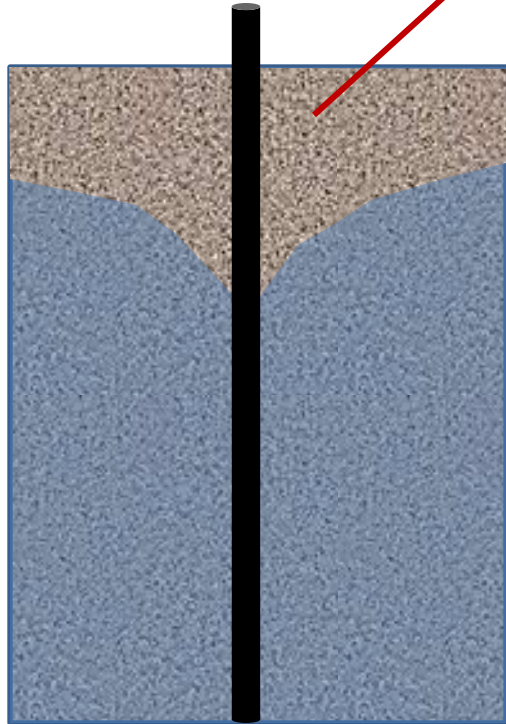


Thank you!

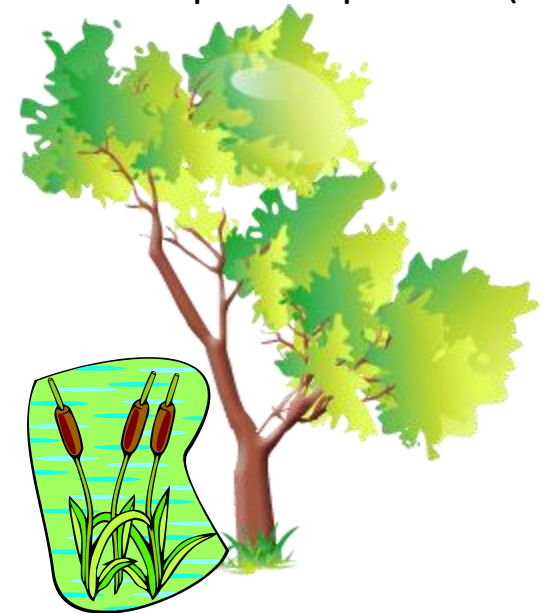


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PUMPED WATER = **AQUIFER STORAGE** + **CAPTURE**



Baseflow



Evapotranspiration (ET)